Localized electron accelerations and drift motions of fine-scale auroral luminous structures

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A number of studies have speculated that shear Alfven waves on transverse scales of the order of an electron inertial length may drive fine-scale (~1 km) auroral features. On these scales, shear Alfven waves are often called inertial Alfven waves (IAWs) and provide a feasible mechanism for field-aligned, small-scale electron acceleration at altitudes of a few thousand kilometers above the aurora, which is often observed as an electron energy-time dispersion in low altitude.

In this study, coincidence between the electron energy-time dispersion, the inverted-V structures, and the auroral fine-scale structures at the geomagnetic footprint is statistically analyzed. The observation is provided by Reimei simultaneous measurements of plasma and auroral images including the footprint area. The result shows that (1) the electron energy-time dispersion tends to appear with drift motions of auroral fine-scale luminous structures at the footprint with high probability, and (2) both the electron energy-time dispersions and the auroral drift motions appear with stronger transverse electric field in the auroral acceleration region (i.e., localized acceleration structures in the inverted-V), where the electric field strength is estimated with spatial variations of electron characteristic energies of the inverted-V structures.

These results suggest that the transverse electric field in the auroral acceleration region might affect on the drift motion of auroral fine-scale luminous structures, and also on the generation of IAWs.